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Phase control and Mössbauer spectra of nano γ - Fe_2O_3 particles synthesized by the levitational gas condensation (LGC) method

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Ⅰ. Introduction

There are many reports on other applications of γ-Fe_2O_3including controlled drug delivery, medical diagnosis, magnetic resonance imaging contrast enhancement], and tissue-specific release of therapeutic agents.[1] The levitational gas condensation (LGC) method is one approach to fabricate nanoparticles of γ-Fe_2O_3 in one step procedure, while the other methods has a little complex.[2] In this article, we report a synthesis and magnetic properties of γ-Fe_2O_3 nanoparticles by the LGC method. The identification of phases has been clarified based on their structural and magnetic properties by X-ray diffraction (XRD), and Mössbauer spectroscopy.

Ⅱ. Experimental Technique.

The levitated liquid Fe droplet simultaneously evaporates and condensates into nanoparticles of γ - Fe_2O_3 with a particle size range from 14 to 30 nm in a chamber filled with Ar and O_2. The as-prepared sample was characterized by XRD, TEM, and Mössbauer spectroscopy.

Ⅲ. Results and Discussion.

Nanoparticles of γ -Fe_2O_3 have been prepared by the levitational gas condensation (LGC) method. From the analysis of Mössbauer spectrum, the amount of γ -Fe_2O_3 and α -Fe in the sample is composed about 92 % and 8 %, respectively, when the O_2 flow rate (V_{O2}) is less than 0.1 l/min. Mössbauer spectra consist of two sets of six Lorentzian lines corresponding to γ -Fe_2O_3 and α-Fe. Mössbauer spectrum indicates magnetic hyperfine fields due to the particle size of 14 to 30 nm as shown in Fig. 1. It was found that phase transformation into Fe_3O_4 from both γ - Fe_2O_3 and α -Fe has a striking dependence on increasing O_2 flow rate ($0.05 \leq V_{O2}$ (l/min) ≤ 0.2) in the chamber.

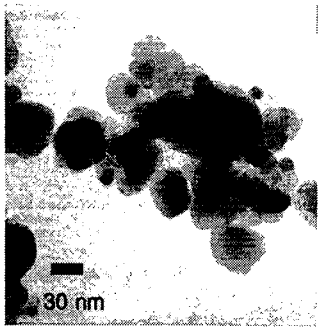

Fig. 1. TEM image for Fe_2O_3 synthesized by LGC.

References

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